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Electrical machine 2……. 2014/2015

Sheet (3)

1) A single-phase, 300kVA, 11kV/2.2kV, 60Hz transformer has the following equivalent circuit parameters referred to the high-voltage side:

Rc_{HV}	57.6kΩ
Xm_{HV}	16.34kΩ
Xeq_{HV}	8.45Ω
Req_{HV}	2.784Ω

(a) Determine:
(i) No-load current as a percentage of full-1φ load current.
(ii) No-load power loss (i.e., core loss).
(iii) No-load power factor.
(iv) Full-load copper loss.

(b) If the load impedance on the low-voltage side is Z_{load} =16∠60° Ω determine the voltage regulation using the approximate equivalent circuit.

2) A1 φ, 250 kVA, 11kV/2.2kV, 60Hz transformer has the following parameters.

$R_{HV} = 1.3$
$X_{HV} = 4.5$
$R_{LV} = 0.05$
$X_{LV} = 0.16\Omega$
$R_{cLV} = 2.4k$
$X_{mLV} = 0.8k$

(a) Draw the approximate equivalent circuit (i.e., magnetizing branch, with R_c and X_m connected to the supply terminals) referred to the HV side and show the parameter values.
(b) Determine the no-load current in amperes (HV side) as well as in per unit.
(c) If the low-voltage winding terminals are shorted, determine
(i) The supply voltage required to pass rated current through the shorted winding.
(ii) The losses in the transformer.

(d) The HV winding of the transformer is connected to the 11kV supply and a load, Z_{load} =15∠ − 90° Ω is connected to the low-voltage winding. Determine:

(i) Load voltage.
(ii) Voltage regulation

3) A1 φ, 25kVA, 2300=230V transformer has the following parameters:

$Z_{eq.H}$	4.0 +j5.0Ω
$R_{c.L}$	450Ω
$X_{m.L}$	300Ω

The transformer is connected to a load whose power factor varies. Determine the worst-case voltage regulation for full-load output.

4) For the transformer in Problem3:
(a) Determine efficiency when the transformer delivers full load at rated voltage and 0.85 power factor lagging.
(b) Determine the percentage loading of the transformer at which the efficiency is a maximum and calculate this efficiency if the power factor is 0.85 and load voltage is 230V.

5) A1 φ, 10 kVA, 2400/240 V, 60 Hz distribution transformer has the following characteristics:

Core loss at full voltage=100W
Copper loss at half load=60W

(a) Determine the efficiency of the transformer when it delivers full load at 0.8 power factor lagging.
(b) Determine the per-unit rating at which the transformer efficiency is a maximum. Determine this efficiency if the load power factor is 0.9.
(c) The transformer has the following load cycle:

No load for 6 hours
70% full load for 10 hours at 0.8 PF
90% full load for 8 hours at 0.9 PF

Determine the all-day efficiency of the transformer.

6) A 320-kVA, 240/4800-V, 60-Hz transformer yielded the following information when tested:

	Voltage(v)	Current(A)	Power(w)

Open-circuit test	240	39.5	1200
Short-circuit test	195	66.67	3925

Find the equivalent circuit of the transformer as viewed from (a) the low-voltage side and (b) the high-voltage side.

7) A 5-kVA, 500/250-V, 50-Hz transformer yielded the following information when tested:

	Voltage(v)	Current(A)	Power(w)
Open-circuit test	500	1	50
Short-circuit test	25	10	60

(a) Determine the efficiency of the transformer when it delivers full load at 0.8 power factor lagging.
(b) Determine the voltage regulation of the transformer when it delivers full load at 0.8 power factor lagging.
(c) Determine the efficiency of the transformer when it delivers 60% full load at 0.8 power factor leading.
(d) Obtain an equivalent circuit of the transformer Referred to the high-voltage side.